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Simulation Support for the
MWTC Project – Preliminary
DSTO Investigation

Peter Ryan, Peter Clark,
Lucien Zalcmán and Cameron Lewis

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Simulation Support for the MWTC Project - Preliminary DSTO Investigation

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DSTO-CR-0003

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ABSTRACT

Surface warfare training for the Royal Australian Navy is undertaken at HMAS WATSON in Sydney using operations room simulators. These facilities, the Integrated Operations Team Training Facility (IOTTF) for the DDG/FFG assets and the ANZAC Ship Combat System Team Trainer (CSTT) are undergoing significant upgrades. However, these trainers need to be linked to provide effective task force command team training for the RAN's surface warfare fleet. The feasibility of linking the simulators using Distributed Interactive Simulation (DIS) is discussed. The requirements for providing DIS gateways for both the IOTTF and the CSTT are examined and the infrastructure needed to run DIS exercises in Australia is investigated. Linking the trainers will offer sophisticated and effective command team training by providing a more realistic training environment with two manned simulated operations rooms. Utilising the established DIS standards would also allow these simulators to be linked to the outside world for a wider range of tactical training.

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Simulation Support for the MWTC Project - Preliminary DSTO Investigation

Executive Summary

Surface warfare training for the Royal Australian Navy (RAN) is undertaken at HMAS WATSON in Sydney. This training encompasses individual skills training, command team training, and task group level tactical training. Operations rooms simulators are used for command team and Principal Warfare Officer (PWO) training.

The command team training facilities in the Tactical Trainer Building (TTB) are undergoing significant upgrades: the recently installed DDG Operations Team Training Facility (OTTF) is being upgraded to include the Frigate (FFG7). This upgraded system will be designated the Integrated OTTF (IOTTF). A separate operations room for the ANZAC Ship Combat System Team Trainer (CSTT) will be installed in 1996. Navy Project SEA 1412 seeks initially to link these simulators to form the foundation of the Maritime Warfare Training Centre (MWTC) which will be used for command team training and tactical development for the RAN's major surface warfare combatants.

DSTO staff are assisting the Director General, Force Development (Sea) (DGFD (Sea)) within Headquarters Australian Defence Force (HQADF) to investigate the feasibility of linking these two simulators using the technology of Distributed Interactive Simulation (DIS) which allows real-time communication between simulators. Linking simulators in this way helps to more closely imitate operational environments, as different platforms (ships/aircraft etc) interact, and therefore will offer more sophisticated and effective command team training. The simulators can also be linked to the outside world through DIS for a wider range of tactical training.

Considerable infrastructure needs to be put in place before multiplayer DIS exercises such as planned at HMAS WATSON between the IOTTF and CSTT can be undertaken in Australia: (1) an Australian DIS military inventory needs to be defined, ratified, and incorporated into the DIS system so that Australian military entities can participate in DIS exercises, (2) common database standards need to be established so that the different simulators are correctly correlated, and (3) a network infrastructure needs to be established to provide the link between the simulators

The recommendations are that:

1. Appropriate DIS infrastructure is established to enable RAN (and other DIS-enabled ADF) simulators to participate in DIS exercises

2. British Aerospace Australia (BAeA), the contractors for the OTTF upgrade, quote on providing a DIS gateway for the IOTTF. BAeA staff can assist in tailoring the DIS Specifications to meet RAN operational requirements.
3. Computer Sciences Corporation Australia (CSCA), the contractors for the ANZAC Ship simulator, quote on adding a DIS gateway to their simulator to meet the combined operational requirement when the two simulators are linked together.
4. CSCA add a DIS gateway to their Collins Submarine control room simulator.
5. The Seahawk simulator at Nowra be investigated to determine the difficulty in adding a DIS gateway.

It was also noted that a standalone simulator for the FFG's SQS56 sonar simulator has been developed at HMAS WATSON. This could have a DIS gateway installed so that it could be connected to a DIS network for participation in exercises.

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1. Background

Surface warfare training for the Royal Australian Navy (RAN) is undertaken at HMAS WATSON in Sydney. This training encompasses individual skills training, command team training, and task group level tactical training. Operations rooms simulators are used for command team and warfare officer training. These operations rooms are functionally simulated based on commercial equipment including a simulated world and full monitor/debriefing facility [1].

An Action Information Organisation Tactical Trainer (AIOTT) was installed at HMAS WATSON in 1975. This facility provided command team training with four interactive operations rooms simulating destroyers and an aircraft carrier. This facility was controlled by a large central computer system comprising a Ferranti Argus 500 mainframe. This system eventually became insupportable and was decommissioned in late 1993.

The AIOTT is being replaced by the Integrated Operations Team Training Facility (IOTTF) which will simulate the operations rooms of both the Guided Missile Destroyer (DDG2) and Frigate (FFG7), and a separate operations room for the ANZAC Ship Combat System Team Trainer (CSTT) which will be installed in 1996. These will be physically separate, independent systems so that there will be no option for command team training between the FFG/DDG and ANZAC Ship simulators such as was provided by the older AIOTT system.

A currently unapproved major capital equipment Project SEA 1412 with year of decision 1996/97 seeks initially to link these command team simulators to form the foundation of the Maritime Warfare Training Centre (MWTC) which will be used for command team training and tactical development for the RAN's major surface combatants [2]. The technology of Distributed Interactive Simulation (DIS) developed in the US provides a means for linking these simulators [3].

2. Distributed Interactive Simulation

2.1 Overview of DIS

The *Distributed Interactive Simulation* protocol was developed for the interconnection of any number of simulators and/or real devices in which the simulated entities are able to interact with each other to conduct a simulated game or exercise. A DIS environment is created through *real-time* exchange of data units between distributed, computationally autonomous simulation applications in the form of simulations, simulators, and instrumented equipment interconnected through standard computer

communicative services. The simulation entities may be present in one location or may be distributed geographically.

The primary mission of the DIS community is to define an infrastructure for linking simulations of various types at multiple locations to create realistic, complex, virtual worlds for the simulation of highly interactive activities. This infrastructure brings together systems built for separate purposes, technologies from different eras, products from various vendors, and platforms from various services and permits them to interoperate. DIS exercises are intended to support a mixture of *virtual entities* (human-in-the-loop simulators), *live entities* (operational platforms and test and evaluation systems), and *constructive entities* (wargames and other automated simulations).

Further technical details on DIS are provided in refs [3-4].

2.2 DIS Design Principles

The principles underlying DIS can be briefly summarised as follows:

(a) *No central computer controls the entire simulation exercise.* DIS uses a distributed simulation approach in which the responsibility for simulating the state of each entity (tank, submarine, carrier, aircraft, missile, etc.) rests with separate simulation applications residing in computers communicating via a network.

(b) *Autonomy of Simulation Nodes.* Each simulation node is autonomous and does not need to know which other nodes require information about its state. The receiving node is responsible for deciding whether an external event affects its simulated entities. This autonomy principle enables nodes to join or leave an exercise without disruption.

(c) *Transmission of Ground Truth Information.* Each node transmits the absolute truth of the state of its simulated entities (location, orientation, velocity etc.). The receiving nodes are responsible for determining whether their objects perceive an event and whether they are affected.

(d) *Transmission of State Change Information.* Nodes transmit only changes in the behaviour of their simulated entities. This minimises the transmission and processing of data.

(e) *Dead Reckoning Algorithms.* Each node maintains a simplified representation of the state of nearby entities and also itself using dead reckoning algorithms and extrapolates their last reported states until the next entity state updates are received. The simple model represents the view of that entity as perceived by other simulations on the network. If its own high fidelity model differs too greatly from its simple dead reckoning model it updates this simple model and also issues state entity data.

2.3 DIS Protocol Data Units

DIS is a networking protocol standard that provides a method of communicating entity state and other information such as radar and sonar emissions through so-called Protocol Data Units (PDUs). These PDUs consist of network packets which are passed electronically between simulation nodes. Standards for DIS PDUs are developed under the guidance of the DIS Steering Committee and utilising the Institute of Electrical and Electronic Engineers (IEEE) Standards approval process. Standards are being developed for entity interaction, communications architecture protocols, environment modelling, requirements for fidelity, exercise control and feedback.

DIS version 1.0 and 2.0 PDUs have achieved the status of IEEE standards [5-6] whereas the DIS 3.0 PDUs are still in draft form [7]. The DIS 1.0 standard has 10 PDUs which support the appearance and movement of entities, weapons firing, detonation of ordnance, collision detection, and logistical resupply of units. This version had a strong Army influence particularly aligned to tank exercises. The DIS 2.0 standard has 17 additional PDUs to provide support for voice radio and tactical data links, simulation management, and electromagnetic emission representation for electronic warfare and laser interactions for smart munitions. DIS version 3.0 will contain further enhancements to support acoustic emissions for underwater warfare, dynamic terrain, environmental effects, fidelity control, and C³I.

2.4 Providing a DIS Interface

A DIS gateway can be implemented in a simulator either through a DIS solution bundled with the existing simulator's CPU or by purchasing additional CPU capacity. In the first case, referred to as the *Software Only Solution* [4], a software library is required which can transmit and receive DIS PDUs over the (DIS) network, filter incoming PDUs to determine if they are relevant to the given simulator, and implement the *DIS Dead Reckoning Algorithm* in this simulator. Data must be converted to and from its own representation and coordinate system to that required by the PDU. The simulator then takes the appropriate action on the entity once it is entered into the game.

As the complexity of the DIS simulation exercise increases, the number of PDUs, the network bandwidth and throughput, and CPU requirements all increase correspondingly. Thus a Software Only Solution is appropriate when the number of entities is low and/or sufficient CPU power is available. A commercial solution, such as the Mak Technology VRLink Toolkit will only run on a limited number of computing platforms (Sun, Silicon Graphics, IBM RS/6000 etc.) which must then have access to the required simulation data.

The alternative method is to purchase additional computing hardware. McDonnell-Douglas provide a *DIS Interface Unit (DIU)* which comes as a plug-in circuit board (eg. VME bus CPU) or a stand-alone computer with the required DIS software (as

described above). This is then connected to the simulator via a high speed link, such as Ethernet or Reflective Memory, which offloads the processing of the PDUs from the simulator host on to the DIU. Extra functionality such as voice/radio communication capabilities, DIS Data Logger capabilities etc., which may require extra VME bus boards or a more powerful standalone computing system, can also be provided.

3. The Integrated Operations Team Training Facility (IOTTF)

3.1 Overview of the IOTTF

The IOTTF is based around integrated Naval Combat Data Systems (NCDS) operations rooms. It was designed by British Aerospace Australia (BAeA) as the prime contractor with the replica operations room equipment constructed by Australian Defence Industries (ADI). When complete, it will provide DDG and FFG operations rooms which operate within the same simulated environment with various cubicles configured as assets such as helicopters and other ships. The system is controlled by a monitor room which enables game and scenario preparation, game control and recording. Communications, sensor, and weapons modelling are included together with weapon profiles (eg. missile trajectory following launch). Environmental modelling affecting radar and communications is planned. Figure 1 shows a block diagram of the IOTTF.

The IOTTF is a distributed system made up of many "multi-purpose monitors" each of which is controlled by a British Aerospace (BAeA) computer. At the start of an exercise a loosely coupled Sun workstation downloads the controlling software (embedded ADA) to each BAeA computer together with an initial exercise scenario. This Sun workstation provides overall simulation management, off-line scenario generation, data recording and playback and general housekeeping support.

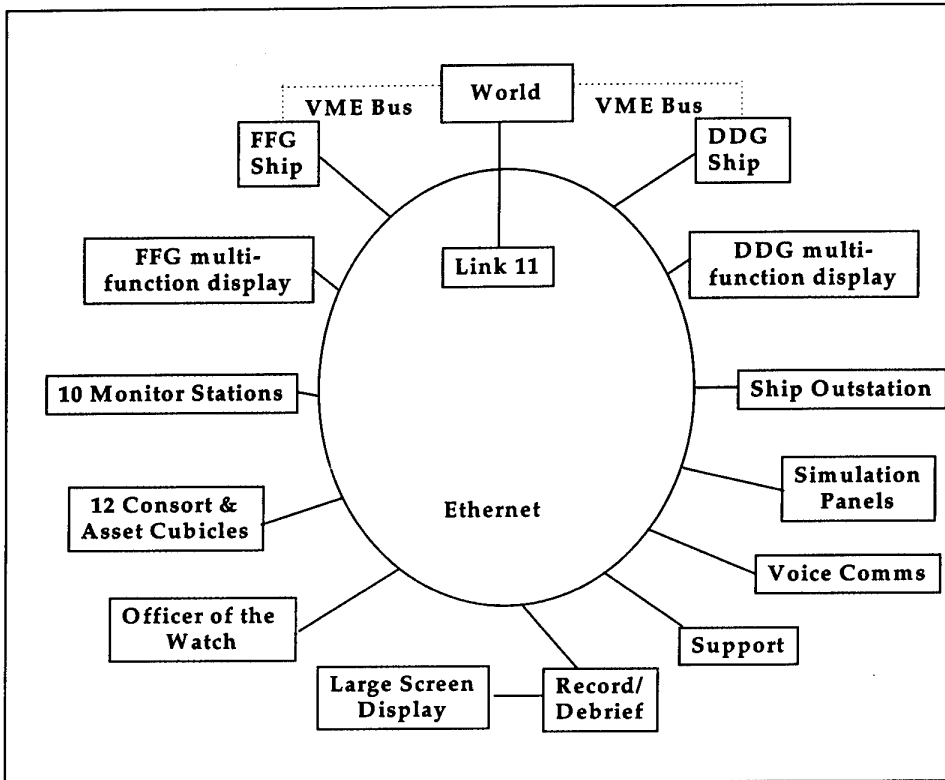


Figure 1: Simplified block diagram of the Integrated Operations Team Training Facility

3.2 DIS Gateway for the IOTTF

The IOTTF simulates all aspects of naval warfare in the operations room environment. Thus Anti-Air Warfare (AAW), Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASUW), Multi-threat warfare, Peace-time Fleet Exercise Programme (FXP) serials, and possibly also mine warfare (MW) scenarios must be capable of being simulated [8]. This necessitates data exchange for a DIS exercise including entity information for platforms (ships, submarines, aircraft) and munitions (missiles, torpedoes, etc.), tactical data links, voice comms between these entities, weapons fire, and also electromagnetic emissions for electronic warfare (EW) and acoustic emissions for underwater warfare. Thus at least the DIS version 2 PDUs must be implemented and more probably DIS 3 since underwater warfare assets such as submarines must also be modelled. These data requirements place considerable demands on the proposed DIS exercises that are envisaged.

Using DIS 1.0 [9] early experience showed that entity state PDUs (ESPDU), which describe the type, position, and appearance of the simulated entity, represented the majority of the traffic. In EW and ASW applications which require later versions of

DIS it is expected that emission PDUs (EMPDU) may produce nearly as much traffic with voice comms/data link PDUs the next greatest component [3]. Doris [10] has studied the likely traffic in high and low rates of activity for various entities involved in a DIS exercise. He estimates that for a high rate exercise the EMPDU/ESPDU ratio for a ship will be 4 whereas for an aircraft it will be 0.5. Thus in a reasonably intense exercise EMPDUs from a ship may predominate. According to Doris [10] the voice and data links, in particular, dominate the PDU traffic during busy phases of the exercise. The requirements for low and high rate traffic are shown in the following table.

Table 1: Sample exercise entity traffic estimates

Entity	Low Rate (Kb/s/entity)	High Rate (Kb/s/entity)
Ship	3.5	46.6
Aircraft	1.1	34.1
Voice Link	65.1	65.1
Data Link	79.4	79.4

Thus a bandwidth of 128 Kbps (Kilobits per second) would be needed to run a close conflict simulation with 3-4 ships/aircraft. To add a voice and/or data link would require at least a 256 Kbps connection. However a larger bandwidth of at least 1 Mbps would be required for a reasonable size, close conflict exercise with 10 ships/aircraft, 5 voice and data links.

BAeA is best placed to add a DIS gateway to the simulator since the IOTTF is currently maintained and also being upgraded by BAeA contractors and the multi-purpose monitors are controlled by specialised proprietary BAeA software. Further detailed investigation is required regarding which DIS PDUs are needed for the potential applications of the IOTTF operations room simulator and to establish the optimal means of providing a DIS gateway to other simulators on the DIS network.

It is recommended that British Aerospace Australia investigate the possibility of adding a DIS Gateway to the IOTTF.

A very approximate costing could be as follows:

- 1) A single DIS gateway (such as a DIU) - \$50K.
- 2) Documentation - depending on the standard required (ie Milspec 2167) and whether any existing documentation needs to be modified. This would require at least \$50K to \$100K.

- 3) Software to couple the DIS gateway to the simulator - it is unlikely that local BAeA contractors have sufficient DIS knowledge because this is a relatively new technology for Australia. Thus BAeA would need to bring in an overseas expert in DIS. In Air Operations Division's (AOD) experience, such an overseas expert would cost approximately \$40K per month and would be required for at least two to three months for a total cost of about \$100K. Additional local contractors may be required totalling about 1 man year costing \$100K. Thus the total cost for software development would be roughly \$200K.

Note that BAeA may already have developed, or be presently developing, a DIS gateway to their simulator and thus may not charge the total development cost.

The cost of the DIS gateway, documentation, and software to couple the gateway to the simulator, adds up to approximately \$150K to \$350K. In addition, BAeA may wish to take into consideration some buffer funds in case it takes longer than required and also a profit margin. In total, a minimum cost of between \$250k to \$500k would be required to DIS the IOTTF.

4. The ANZAC Ship Combat System Team Trainer

4.1 Overview of the CSTT

The ANZAC simulator is scheduled to be installed at HMAS WATSON in 1996. Various components of the ANZAC simulator are being constructed at Computer Sciences Corporation Australia (CSCA) at St. Leonards in Sydney and at Williamstown ship yards in Melbourne. The CSTT uses military specification hardware and software so that crews will train on actual equipment driven by operational software. This system will interact with a simulated world which provides both simulation and stimulation to the milspec equipment. The CSTT will include its own monitor workstations to control the game and record/debrief like the OTTF. Sensor and weapons modelling will be accurate and realistic. A block diagram of the ANZAC CSTT is shown in Figure 2.

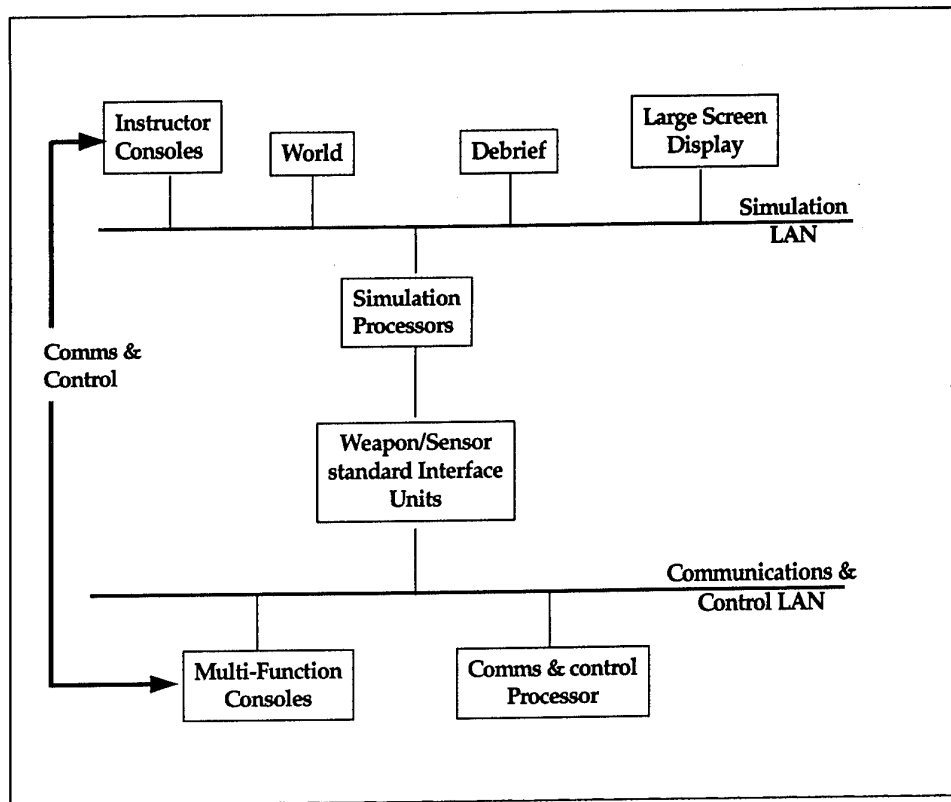


Figure 2: Simplified block diagram of the ANZAC Ship Combat System Team Trainer

4.2 DIS Gateway for the CSTT

The comments in section 3.2 for the IOTTF regarding DIS data demands apply for the CSTT also. The current DIS 2.0 standard or greater will certainly be required for the types of data exchange for the entities needed to provide naval command team training.

As for the IOTTF simulator most of the ANZAC Ship simulator software is written in the ADA programming language. Controlling components of the simulator (eg the World Simulation) run on Sun Workstations under the Solaris (ie Sun's version of Unix) Operating System. The ANZAC Ship simulator software/hardware architecture is so structured that to add a DIS gateway appears to be feasible.

Discussions with CSCA staff (Peter Morgan, System Architect and Michael Norsa, Deputy Programme Manager of the ANZAC Ship Shore Installations Projects) at St. Leonards indicate that they are interested in DIS. They are well aware of the advantages of DIS and have considerable DIS documentation available in-house. They are already considering whether they should add DIS to the ANZAC Ship simulator.

It is recommended that CSCA investigate adding a DIS Gateway to the ANZAC Ship CSTT.

4.3 CSCA Simulators for Submarine and Helicopter

CSCA is also developing the Collins Submarine simulator for the Navy which is due to be delivered in 1997 to HMAS WATSON. It will eventually be moved to HMAS STIRLING in Western Australia with the Submarine Warfare Systems Centre (SWSC). CSCA (Dennis Macdonald, Development Manager, Submarine Programme, Major Defence Systems) is looking at the possibility of providing a second submarine simulator capability which would share the same general purpose consoles and operations room equipment used by the first simulator. Only high level information would be exchanged between the two submarine simulators which will allow submarine against submarine exercises to be carried out. Discussions with CSCA staff indicated that a DIS gateway would allow these submarine simulators to connect to combined exercises carried out on a DIS network.

It is recommended that CSCA investigate adding a DIS Gateway to the Collins Submarine simulator.

CSCA also maintain the Seahawk simulator at Nowra for the Navy but the CSCA staff present were not aware of its architecture or if DIS had been considered for this simulator.

It is recommended that the Seahawk simulator be inspected to see how difficult it would be to add a DIS Gateway to this simulator.

5. An Australian Defence Simulation Internet (DSI) - A DIS Network

In addition to providing DIS interfaces on the above-mentioned simulators, certain DIS infrastructure needs to be put in place before multiplayer DIS exercises can be undertaken in Australia. Issues which need to be addressed on an ADF-wide basis are discussed in the following sections.

5.1 Establishment of an Australian Military Inventory

DIS requires an enumerated listing of all entity types that can participate in an exercise. This listing must be available to every player in an exercise to enable them to resolve the identity of other players from the numeric identifier transmitted across the network. The official list of known entity types is defined in ref. [11]. An equivalent Australian military inventory needs to be defined, ratified, and incorporated into this document so that Australian military entities can also participate in DIS exercises.

5.2 Establishment of Common Database Standards

A DIS exercise involves a number of players interacting in a virtual world. For this interaction to be valid, a high degree of correlation is required between the versions of the virtual worlds each player is operating within. While this is less of an issue for seaborne vehicles than for land and airborne vehicles there are still significant interactions with coastlines, sea floors, etc which need to be correlated accurately between the various players.

A first step towards improving the database correlation is to derive all databases from common source data. Digital Terrain Elevation Data (DTED) and Digital Feature Analysis Data (DFAD) are good starting points for generating simulation databases and there are many tools available to assist this process. The Royal Australian Survey Corps is currently generating DTED and DFAD data for significant areas of Australia.

A better approach to improving database correlation is for all simulators to make use of a common database. The US Department of Defence is currently developing a standard for the interchange of simulator databases under the designation Project 2851. This standard (currently in draft) is called *Standard Simulator Data Base (SSDB) Interchange Format (SIF)* [12]. SIF is intended to be used in conjunction with DIS. It is desirable that simulations that are to participate in DIS exercises have the ability to import SIF data. SIF can also reduce the cost of database development by allowing reuse of databases between simulators.

5.3 Establishment of a Network Infrastructure

During development of DIS capabilities and possibly during low-level DIS exercises simple point-to-point network links may be adequate for connecting DISed simulators together. However, connecting more than two simulators together will require one or more interconnected network hubs providing bridging or routing capabilities.

Dial-up ISDN type connections (64kb/sec to 1.5Mb/sec bandwidth) to this DIS network will probably be adequate in the short term. These ISDN connections are relatively low cost and easily scalable in performance. If higher bandwidth connections

are required then a service such as Telecom's FastPac (2 or 10Mb/sec bandwidth) may be used. If there is particularly high usage between specific sites then dedicated lines may be more cost effective.

In the short term DSTO may be able to provide limited hub facilities for low bandwidth ISDN connections. In the longer term this function should probably be handled by a dedicated section within Defence.

Security issues will also need to be addressed. If classified systems are to be connected across the network then approved encryption devices will be required.

6. DIS for Sonar Simulator at HMAS WATSON

6.1 SQS56 Sonar Simulator and Tactical Environment

SERCO, in-house contractors at HMAS WATSON, have developed a simulator for the FFG SQS56 sonar which incorporates a tactical environment. This simulator could be *DISed* and linked to the Air Operations Simulation Centre (AOSC) [13] with appropriate tools as a means of initiating the development of DIS at HMAS WATSON.

Both the Tactical Environment and the Sonar Simulator are based on Intel 80486 processors running under the MS-DOS operating system with software written in Borland C++. MaK Technology's VRLink Toolkit used in the AOSC is also available for MS-DOS platforms using both Microsoft's and Borland's C/C++ compilers. Implementing a minimum DIS for these simulators may take as little as a few man weeks once the VRLink Toolkit has been acquired.

6.2 A DIS Implementation Strategy for the SQS56 Simulator

The Sonar Simulator is connected to the Tactical Environment via a standard RS-232 line. High level information is sent either one or both ways along this line.

The following multi-step strategy is suggested:

- 1) DIS the combined Tactical Environment / Sonar Simulator. The VRLink Toolkit can be used to define and place PDUs from entities (submarines, destroyers, torpedoes etc.) created in the Tactical Environment (TE) on the network. DIS PDUs can also be captured and used by the TE with VRLink. The combined TE/Sonar Simulator can then be connected to a DIS network for participation in exercises.

- 2) Alternatively, both the SQS56 and the TE can be considered as separate devices and *could both be DISed* so that the "proprietary" RS-232 line can be abandoned. The two devices can communicate via DIS PDUs created in both the TE and the SQS56 simulator. Thus there would be two totally independent DIS devices which can independently participate in a DIS exercise.
- 3) Have a low bandwidth (64 or 128 KiloBaud) private link put in between HMAS WATSON and the AOSC. This will, initially, allow the AOSC to provide remotely generated PDU's to ensure that the HMAS WATSON Tactical Environment and/or the Sonar Simulator are using DIS correctly. Simulated assets within the AOSC may then participate in testing and development of the system.

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8. Glossary of Acronyms

AAW	Anti-Air Warfare
ADI	Australian Defence Industries
AIOTT	Action Information Organisation Tactical Trainer
AOD	Air Operations Division (of DSTO)
AOSC	Air Operations Simulation Centre
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
BAeA	British Aerospace Australia
C ³ I	Command, Control, Communications, and Intelligence
CPU	Central Processor Unit
CSCA	Computer Sciences Corporation Australia
CSTT	Combat System Team Trainer
DFAD	Defence Feature Analysis Data
DGFD	Director General Force Development
DIS	Distributed Interactive Simulation
DIU	DIS Interface Unit
DSTO	Defence Science & Technology Organisation
DTED	Digital Terrain Elevation Data
EMPDU	Emission PDU
ESPDU	Entity State PDU
EW	Electronic Warfare
FXP	Fleet Exercise Programme
HQADF	Headquarters, Australian Defence Force
IEEE	Institute of Electrical and Electronic Engineers
IOTTF	Integrated Operations Team Training Facility
ISDN	Integrated Services Digital Network
MOD	Maritime Operations Division (of DSTO)
MS-DOS	MicroSoft Disk Operating System
MW	Mine Warfare
MWTC	Maritime Warfare Training Centre
NCDS	Naval Combat Data Systems
OTTF	Operations Team Training Facility
PDU	Protocol Data Unit
PWO	Principle Warfare Officer
SIF	Standard Interchange Format
SSDB	Standard Simulator DataBase
SWSC	Submarine Warfare Systems Centre
TE	Tactical Environment
TTB	Tactical Trainer Building
VME	Virtual Memory Enhanced (type of electronic bus)

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20. ABSTRACT Surface warfare training for the Royal Australian Navy is undertaken at HMAS WATSON in Sydney using operations room simulators. These facilities, the Integrated Operations Team Training Facility (IOTTF) for the DDG/FFG assets and the ANZAC Ship Combat System Team Trainer (CSTT) are undergoing significant upgrades. However, these trainers need to be linked to provide effective task force command team training for the RAN's surface warfare fleet. The feasibility of linking the simulators using Distributed Interactive Simulation (DIS) is discussed. The requirements for providing DIS gateways for both the IOTTF and the CSTT are examined and the infrastructure needed to run DIS exercises in Australia is investigated. Linking the trainers will offer sophisticated and effective command team training by providing a more realistic training environment with two manned simulated operations rooms. Utilising the established DIS standards would also allow these simulators to be linked to the outside world for a wider range of tactical training.					